

Does Expansionary Monetary Policy Cause Asset Price Booms; Some Historical and Empirical Evidence

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Preliminary Draft. Not for Quotation

Paper prepared for the Sixteenth Annual Conference of the Central Bank of Chile,
“Macroeconomic and Financial Stability: Challenges for Monetary Policy”
Santiago, Chile, November 15-16 2012

¹ The authors would like to acknowledge the excellent research assistance provided by Antonio Cusato during this project. All remaining errors are our own.

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I. Introduction

Does expansionary monetary policy lead to asset price booms? There is an extensive theoretical empirical and policy literature on this topic. The traditional view sees expansionary monetary policy as raising asset prices as part of the transmission mechanism of monetary policy. It works through the adjustment of the community's portfolio as agents substitute from cash to government securities to corporate securities; to equities; to real estate; old masters and commodities—eventually leading to overall inflation. Another view attributed to the Austrian economists in the 1920s and more recently to the BIS sees an environment of low inflation and accommodative monetary policy as creating an environment conducive to asset booms and consequent busts.²

Asset booms (especially those leading to bubbles) are often followed by busts which can have serious economic effects. There is a long historical incidence of infamous boom busts ranging from the South Sea bubble in the early eighteenth century, many famous stock market crashes in the nineteenth century, the 1929 Wall Street Crash, the UK housing boom bust of 1973, the Nordic crises of the 1980s, the Japanese housing and equity bubble and crash of 1990 and the more recent dotcom and subprime mortgage boom busts. This history keeps repeating itself.

The policy implications of asset booms are significant, especially since asset busts have often tended to lead to banking crises and serious and prolonged recessions. To the extent

² Related approaches emphasize financial liberalization and innovation accommodated by loose monetary policy as conducive to creating booms.

monetary policy is a contributing factor, the question arises whether the monetary authorities should use their policy tools to defuse booms before they turn into busts. A vociferous debate raged in the early 2000s and until the aftermath of the recent financial crisis over the subject of preemptive policy action. Central banks were unwilling to divert much attention away from their traditional concern over price and overall macro stability. However the tide has recently turned and the new emphasis on macro prudential monetary policy suggests that asset price booms have been elevated to the top level of interest.

Finally, the issue still remains that asset price booms in addition to sometimes ending with damaging busts can be the precursors to a future run up in inflation. This then leads to the question of when central banks should tighten their policies to prevent inflation from becoming embedded in expectations.

In this paper we develop a method to demarcate asset price booms. We focus on house price booms, stock market booms and commodity booms for 18 OECD countries from 1920 to the present. We then ascertain whether our set of boom events can be related to different measures of expansionary monetary policy; deviations from Taylor rules and monetary aggregate growth. Finally we use panel VAR regression techniques to control for other determinants of asset booms including: financial liberalization, credit growth, inflation, and the current account deficit.

Section II discusses the debate over the linkage between monetary policy and asset price booms. Section III contains historical narratives on some of the salient asset price booms in history. We discuss some booms in nineteenth century Great Britain, the Wall Street stock market boom in the 1920s and the US housing boom of the 20s, the commodity price boom of the 1970s, the UK housing booms in the 1970s and 1980s, the Nordic asset booms in the 1980s,

the Japanese boom of the late 80s, the dotcom boom of the 90s and the recent subprime mortgage boom bust. Section IV discusses our methodology of identifying asset price booms and presents a chronology from 1920 to the present of the booms so identified. Section V uses econometrics to isolate the links between expansionary monetary policy and asset price booms, controlling for other factors. Section VI concludes with the implications of our findings for monetary policy.

Section II: The Issues

Debate swirls over the causes of the subprime Mortgage Crisis of 2007-08 and the Great Recession of 2007-2009 and the subsequent slow recovery. Two views predominate; the first is that it was caused by global imbalances: a global savings glut in Asia which financed a consumption boom, persistent budget deficits and current account deficits in the U.S and other advanced countries. The second that it reflected domestic imbalances in the U.S. leading to an unprecedented nationwide housing boom which burst in 2006 precipitating the crisis. This paper focuses on the second view.³

A key element of the domestic U.S. story is that the Federal Reserve kept monetary policy too loose from 2002-2006 which fueled a housing boom that had its origins in a long tradition of policies to encourage home ownership in succeeding administrations, financial innovation, lax regulatory supervision and oversight and corporate malfeasance. John Taylor

³ The possibility that monetary policy can produce asset price bubbles has also been studied extensively in equilibrium rational expectations models. In such models, poorly designed monetary policies, such as the use of interest rate rules without commitment to a steady long-run inflation rate, can lead to self-fulfilling prophecies and asset price bubbles. Such outcomes are less likely, Woodford (2003) argues, if monetary policymakers follow a clear rule in which the interest rate target is adjusted sufficiently to stabilize inflation. The theoretical literature thus suggests that consideration of the monetary policy environment may be crucial to understanding why asset booms come about.

(2007) (2009) has led the indictment of the Fed for fueling the housing boom in the early 2000s. Based on the Taylor Rule (1999) he shows that the Federal Funds rate was as low as 3 percentage points below what a simple Taylor rule would generate for the period 2002-2005. Taylor then simulated the path of housing starts had the Fed followed the Taylor rule over the period 2000 to 2006. His calculations suggest that most of the run up in housing starts from 2002 to 2005 would not have occurred.

An earlier OECD study by Ahrend et al (2005) found a close relationship between negative deviations of the Taylor rule and several measures of housing market buoyancy (mortgage lending, housing investment, construction investment and real house prices) for a number of OECD countries in the early 2000s. The principal examples are U.S. (2000-2006), Canada (2001-2007), Denmark (2001-2004) and Australia (2000-2003). For the euro area as a whole, they find that ECB policy rates are not far below the Taylor rule but for a number of individual members (Portugal, Spain, Greece, Netherlands, Italy, Ireland and Finland) they are well below it. This evidence as well as evidence in several other papers (Hott and Jakipii 2012, Gerlach and Assenmacher- Wesche 2008a) suggests that expansionary monetary policy had a key role to play in fostering recent housing booms, some of which led to devastating busts. Other literature finds evidence linking expansionary monetary policy to equity booms and commodity price booms (Gerlach and Assenmacher Weshe 2008b, Pagano, Lombardi, Anzuini 2010).

Expansionary monetary policy can also generate booms in commodity prices which can presage a run up in global inflation. The Great Inflation of the 1970s was first manifested in commodity prices before feeding into overall inflation. This reflected the basic distinction first pointed out by Okun (1975) between goods that are traded in auction markets and whose prices react quickly to both nominal and real shocks and goods traded in customer markets (manufactured goods and

services) whose prices are relatively sticky. In the long-run, the paths of prices for both types of goods are determined by the long-run growth of the money supply (reflecting monetary neutrality). What happens in episodes of expansionary monetary policy characterized by falling real interest rates is that real commodity prices rise much more quickly than the prices of other goods and according to Frankel (2008) they overshoot the long-run equilibrium price level. At the same time the prices of other goods react slowly to the monetary pressure. Frankel (2008) finds that commodity prices are a good predictor of future inflation. Browne and Cronin (2007) use time series techniques for the US (1959- 2005) to show that the growth of M2 and headline inflation are cointegrated but that the adjustment mechanism to the long-run equilibrium involves considerable overshooting by commodity prices. Moreover the deviation of commodity prices from their long-run equilibrium values explains the subsequent path of the CPI.

There is an extensive earlier literature on the relationship between monetary policy and asset prices. Asset prices are viewed as a key link in the transmission mechanism of monetary policy. The traditional view argues that added liquidity causes asset prices to rise as a link in the transmission mechanism of monetary policy actions to the economy as a whole. Another view, the Austrian/BIS view argues that asset price booms are more likely to arise in environments of low and stable inflation and thus asset price booms can arise because monetary policy is geared to credibly stabilizing prices.

The traditional view has a long history. Early Keynesian models like Metzler (1951) had central bank operations affecting the stock market directly. Friedman and Schwartz (1963) and later Tobin (1969) and Brunner and Meltzer (1973) spelled out the transmission mechanism following an expansionary Fed open market purchase. It would first affect the prices (rate of return) on short –term government securities, then via a portfolio balance substitution

mechanism, the price (rate of return) of long-term government securities then corporate securities, equities, real estate, old masters and commodities including gold would be bid up (their returns lowered). Thus substitution from more to less liquid assets would occur as returns on the former decline relative to the latter. Thus the impact of expansionary monetary policy will impact securities, assets and commodities and finally the overall price level. This view sees asset prices as possible harbingers of future inflation.

The Austrian/BIS view which goes back to Hayek, von Mises, Robbins⁴ and others in the 1920s posits that an asset price boom whatever its fundamental cause, can degenerate into a bubble if accommodative monetary policy allows bank credit to rise to fuel the boom. This view argues that unless policy-makers act to defuse the boom, a crash will inevitably follow that in turn may cause a serious recession. The Austrians equated rising asset prices with a rise in the overall price level. Although the level of U.S. consumer prices was virtually unchanged between 1923 and 1929, the Austrians viewed the period as one of rapid inflation fueled by loose Federal Reserve policy and excessive growth of bank credit (Rothbard 1983).

The Austrian view has carried forward into the modern discussion of asset price booms. It has been incorporated into the BIS view of Borio and Lowe (2002), Borio and White (2003) and others. They focus on the problem of “financial imbalances” defined as rapid growth of credit in conjunction with rapid increases in asset prices and possibly investment. Borio and Lowe (2002) argue that a build-up of such imbalances can increase the risk of a financial crisis and macroeconomic instability. They construct an index of imbalances based on a credit gap (deviations of credit growth from trend), an equity gap, and an output gap, to identify incipient asset price declines that can lead to significant real output losses, and advocate its use as a guide

⁴ See Laidler (2003).

for proactive action. In this vein Borio (2012) discusses a financial cycle based on property prices and credit growth which has much greater amplitude than the business cycle and when its peak coincides with a business cycle peak, a housing bust, banking crisis and deep protracted recession can follow, as occurred in 2007.

Borio and Lowe argue that low inflation can promote financial imbalances regardless of the cause of an asset price boom. For example, by generating optimism about the macroeconomic environment, low inflation might cause asset prices to rise more in response to an increase in productivity than they would otherwise would. Similarly, an increase in demand is more likely to cause asset prices to rise if the central bank is credibly committed to price stability. A commitment to price stability that is viewed as credible, Borio and Lowe (2002) argue, will make product prices less sensitive and output and profits more sensitive in the short-run to an increase in demand. At the same time, the absence of inflation may cause policy makers to delay tightening as demand pressures build up. ⁵Thus they contend (pp. 30-31) “these endogenous responses to credible monetary policy (can) increase the probability that the latent inflation pressures manifest themselves in the development of imbalances in the financial system, rather than immediate upward pressure in higher goods and service price inflation.”

In section V below we present some evidence distinguishing between the loose monetary policy explanation for asset price booms and the Austrian BIS view that regards monetary policy

⁵ A related issue to the impact of expansionary monetary policy on asset prices is whether the price index targeted by the central bank should include asset prices. Alchian and Klein (1973) contend that a theoretically correct measure of inflation is the change in the price of a given level of utility, which includes the present value of future consumption. An accurate estimate of inflation, they argue, requires a broader price index than one consisting only of the prices of current consumption goods and services. To capture the price of future consumption, Alchian and Klein (1973) contend that monetary authorities should target a price index that includes asset prices. Bryan et al (2002) concur, arguing that because it omits asset prices(especially housing prices), the CPI seriously understated inflation during the 1990s.

dedicated to low inflation (and hence low nominal interest rates) as creating an environment conducive to an asset boom.

III Historical narrative

III.1 The Nineteenth Century

Asset booms and busts have been a major part of the economic landscape since the early eighteenth century. Classic stock market booms followed by wrenching busts were the South Sea Bubble in England and John Law's Mississippi scheme in France (see Neal (2011) and Velde (2003). In the nineteenth century there were major stock market boom busts across the world which accompanied the advent of equities to finance the rapid economic development that followed the industrial revolution. Two famous stock market booms and busts in England occurred in the 1820s and the 1840s.

The earliest and probably most famous stock market boom-bust in the modern era ended with the 1824-25 stock market crash (Bordo 1998, Bordo 2003, Neal 1998). After the Napoleonic wars and the successful resumption of the gold standard in 1821, the British economy enjoyed a period of rapid expansion, stimulated by an export boom to the newly independent states of Latin America and investment in infrastructure projects (e.g. gas lighting, canals and railroads). The sale of stocks to finance those ventures, in addition to gold and silver mines (some real, some fictitious) in Latin America propelled a stock market boom fueled by the Bank of England's easy monetary policy. Prices rose by 78% in the boom. Indications are that the April 1825 collapse in stock prices was related to the prior tightening of the Bank of England's monetary policy stance in response to a decline in its gold reserves. The collapse in which stock prices fell by 34% triggered bank failures, which, once they reached important City

of London banks, precipitated a fully-fledged panic in early December. Only then did the Bank of England begin to act as a lender of last resort but it was too late to prevent massive bank failures, contraction of loans, and a serious recession.

The 1840s railroad mania was a precedent to the 1990s dot com boom. After the first successful railroad was established in 1830, optimistic expectations about potential profits that later turned out to be overly optimistic led to massive investment in rails and rolling stock, which extended the network across the country. The boom was accommodated by expansionary monetary policy in response to gold inflows. The end of the railroad boom was associated with the banking panic of 1847—one of the worst in British history. The crash, in which stock prices fell by 30% and the panic, as in earlier episodes, may have been triggered by tightening of the Bank of England's monetary policy stance, reflecting its concern over declining gold reserves (Dornbusch and Frankel 1984). The panic led to many bank failures and a serious recession.

The U.S. had many stock market booms and busts in its history. Several of them were associated with banking panics and serious recessions. One of the classic boom busts was the railroad boom in the 1870s which opened up the west. The post-civil war era experienced one of the most rapid growth rates in U.S. history. Much of the financing of railroad investment came from British capital inflows which in turn accompanied by gold inflows permitted monetary expansion. The boom was also accompanied by corporate malfeasance and corruption (Bordo and Benmelech 2008). The boom ended with a stock market crash in 1873 once the extent of the corporate fraud was revealed. The stock market crash was followed by a banking panic and a recession which only ended in 1879.

III.2 The 1920s

The most famous episode of an asset price boom is the Wall Street Boom beginning in 1923 and ending with the Crash in October 1929. During the boom stock prices rose by over 200%, the collapse from 1929 to 1932 had prices decline by 66%. The boom was associated with massive investment that brought the major inventions of the late nineteenth century, eg electricity and the automobile, to fruition. In addition, major innovations also profoundly changed industrial organization and the financial sector, including the increased use of equity as a financial instrument. The economy of the 1920s (following the sharp recession of 1920-21) was characterized by rapid real growth, rapid productivity advance and slightly declining prices, punctuated by two minor recessions. Irving Fisher and other contemporaries believed that the stock market boom reflected the fundamentals of future profits from the high growth industries that were coming on stream and that it was not a bubble. Recent work by McGrattan and Prescott (2003) concurs with that view although many others regard it as a bubble (Galbraith 1955, White and Rapoport 2004).

Debate continues over the role of expansionary Federal Reserve policy in fueling the boom. In 1932 Adolph Miller, a member of the Federal Reserve Board blamed the New York Fed and its President Benjamin Strong for pursuing expansionary open market purchases to help Britain restore the pound to its prewar parity in 1924 and then again in 1927 to protect sterling from a speculative attack. In both occasions, the U.S. economy was in recession justifying expansionary policy (Friedman and Schwartz 1963). Miller indicted Strong (who died in 1928) for fueling the stock market boom and the resultant crash. His views were instrumental in

legislation in 1933 which prohibited Reserve banks from engaging in international monetary policy actions.

As mentioned in Section II above the Austrian economists later followed by economists at the BIS saw the 1920s as a credit boom accommodated by monetary policy. Eichengreen and Michener (2004) present evidence for the BIS view for the 1920s as a credit boom gone wild, based on their measures of a credit boom (deviations from trend of the ratio of broad money to GDP, the investment ratio and real stock prices) for a panel of 9 countries.

The 1920s also witnessed a major house price boom in the U.S. from 1923 to 1925. White (2009) argues that the boom was in part triggered by expansionary monetary policy. He finds that deviation from a Taylor rule has some explanatory power for the run up in real housing prices. He also argues that the Fed, established in 1914 to act as a lender of last resort and to reduce the seasonal instability in financial markets, created some elements of a “Greenspan Put” – the view that emerged after Chairman Greenspan engineered a massive liquidity support for the New York money center banks during the October 1987 Wall Street Crash – that the Fed would bail out the financial sector in the event of a crash. Unlike the Wall Street stock market boom, the housing boom bust in the 1920s had little impact on the economy as a whole or on the financial system.

III.3 Post World War II

The post war period has exhibited a large number of housing and stock market boom busts. Many of these episodes occurred in an environment of loose monetary policy. In addition, expansionary monetary policy across the world in the 1960s and 1970s led to a global

commodities boom which presaged the Great Inflation. We briefly discuss a number of salient episodes.

III.3.1 Asset Booms in the UK.

The UK had a massive house price and stock market boom in 1971-1974, referred to by Tim Congdon (2005) as the Heath Barber Boom after the then Prime Minister and Chancellor of the Exchequer. Congdon documents the rapid growth in broad money (M4) after the passage of the Competition and Credit Control Bill in 1971 which liberalized the UK financial system and ended the rate setting cartel of the London clearing banks. He shows both rapid growth in M4 and a shift in its composition towards balances held by the corporate and financial sectors away from the household sectors. Following the Friedman and Schwartz (1963) transmission story, the excess cash balances went into equities first and properties second, greatly pushing up their prices. The big asset price booms were soon followed by an unprecedented rise in inflation to close to 20% per year by the end of the 1970s. Congdon also shows a tight connection between expansion in broad money supply in 1986/87 and subsequent asset price booms which he calls the Lawson boom after the Chancellor of the Exchequer. As in the 1970s boom, rapid growth in M4 and in its holdings by the corporate and financial sectors fueled a stock market boom which burst in 1987 and a housing boom which burst in 1989. Finally he attributes a big run up in financial sector real broad money holdings in 1997/98 to an equities boom in the late 90s and a housing boom which peaked in 2006.

III.3.2 Nordic Asset Booms in the 1980s

The Nordic countries, Norway, Sweden and Finland all experienced major asset booms and busts in the 1980s. In each country the run up in asset prices followed liberalization of their financial sectors after 5 decades of extensive controls on lending rates and government control over the sectoral allocation of bank lending. Asset booms were accommodated by expansionary monetary policy as each country adhered to pegged exchange rates which tended to make monetary policy pro-cyclical.

In the case of Norway, quantitative restrictions on bank lending were lifted in 1984 without allowing interest rates to rise. Real interest rates were low and sometimes negative. Banks used their newborn freedom to expand lending on a large scale, all of them with a firm desire to increase their market shares. This stimulated a massive real estate boom until 1986. The boom ended with tighter monetary policy in 1986. The legacy of the collapse of the real estate boom and the buildup in bad assets in the commercial banks was a banking crisis in 1991 and a recession (Steigum 2009).

Similar stories occurred in Finland and Sweden (Jonung et al 2009). Their crises and recessions were much worse than in Norway largely because their currencies were pegged to the DM in the EMS system and they were hard hit by tight German monetary policy in reaction to the high fiscal costs of German reunification.

III.3.4 Japan in the 1980s

The Japanese boom-bust cycle began in the mid-1980s with a run up of real estate prices fueled by an increase in bank lending and easy monetary policy. The Bank of Japan began following a

looser monetary policy after the Plaza Accord of 1985 to attempt to devalue the yen and ease the upward pressure on the dollar. The property price boom in turn led to a stock market boom as the increased value of property owned by firms raised future profits and hence stock prices (Iwaisako and Ito 1995). Both rising land prices and stock prices in turn increased firms' collateral encouraging further bank loans and more fuel for the boom. The bust may have been triggered by the Bank of Japan's pursuit of a tight monetary policy in 1989 to stem the asset market boom.

The subsequent asset price collapse in the next five years led to a collapse in bank lending with a decline in the collateral backing corporate loans. The decline in asset prices further impinged on the banking system's capital, making many banks insolvent. This occurred because the collapse in asset prices reduced the value of their capital. Lender of last resort policy prevented a classic banking panic but regulatory forbearance propped up insolvent banks. It took over a decade to resolve the banking crisis and Japan is still mired in slow growth.

III.3.4 The 1994-2000 U.S. Dot Com Stock Market Boom

The stock market of the 1990s in the U.S. (and other countries) had many of the elements of the railroad boom in England in the 1840s and the 1920s Wall Street boom including rapid productivity growth and the dissemination and marketing of technologies that had been developed earlier. Massive funds flowed from IPOs and the stock market to finance companies using the new high tech personal computer and internet based technologies. Significant run ups in the market value of leaders like AOL and Microsoft (even before they reported profits) led

others to join in the game. The investment boom in the IT industry led to a stock price boom in the late 1990s which burst in 2000.

As in earlier booms, easy bank (and non-bank credit) finance was crucial, as well as accommodative monetary policy. As in the 1920s boom the question arose whether the rise in stock prices reflected underlying fundamentals (referred to as the “New Economy”) or a speculative bubble. The BIS view attributed the boom to the environment of low inflation and credibility for low inflation produced by the Federal Reserve and other central banks during the Great Moderation of the 1980s and 1990s. In this opinion, central banks focused on low inflation did not see the risks that the benign environment had of fostering an asset boom.

III.4.1 Commodity Price Booms: the 1930s

The recovery from the Great Contraction after 1933 witnessed a global commodity boom. Friedman and Schwartz (1963) document the policies of Franklin Roosevelt and his Secretary of the Treasury, Henry Morgenthau, to purchase gold and silver in the London market to reflate the U.S. economy. They were following the approach suggested by George Warren and Frank Pearson (1935). The Treasury gold and silver purchases succeeded in pushing up gold and silver prices in the London commodity market and may have also helped produce the general commodity boom of the mid-1930s. Other factors would have been global recovery and the looming threat of World War II.

III.4.1 Commodity Price Booms: the 1970s

The massive commodities boom in the 1970s has been viewed as a precursor of the Great Inflation. Following the monetarist transmission mechanism, expansionary monetary policy pushed up highly inelastic raw materials prices which then later fed into the prices of intermediate goods and final goods (Bordo 1980). An alternative widely held view at the time was that there were a series of negative supply shocks in the 1970s which accounted for the boom (Blinder and Rudd 2008). The most memorable events of the time were the two OPEC Oil price shocks of 1974 and 1978. However Barsky and Killian(2001) present evidence that what led to the formation of the OPEC cartel and its constriction of supply was an attempt to compensate the oil producers for a decline in the real value of oil prices in terms of dollars. This reflected global inflation aided by expansionary U.S.(and other countries) monetary policies beginning in the mid-1960s.

III.4.2 Commodity Price Booms: the 2000s

A run up in commodity prices in the 2000s has popularly been attributed to globalization and the rapid growth of emerging market economies, especially China, which pushed up the prices of commodities like copper crucial to their economic development. However there is also an argument that the boom reflected expansionary monetary policy in the U.S. and other advanced countries concerned over the threat of deflation after the dot.com boom burst (Frankel 2008). The rise in commodity prices then fed into global inflation (Browne and Cronin 2007, Ciccarelli and Mojon 2010).

IV. Identifying Asset Price Booms

Before outlining our econometric approach we first identify asset price booms for real house prices, real stock prices and real commodity prices. To identify asset price booms we first date the turning points of our real asset price series using the method described in Harding and Pagan (2002) and Pagan and Sossounov (2003). In these two related papers the authors use the method of Bry and Boschan (1971) to date turning points of time series. In this paper we do the same. For real house prices and real commodity prices we look for peaks (troughs) that are higher (lower) than the two nearest observations on each side of the turning point under the constraint that peaks and troughs must alternate. For real stock prices, because of the higher volatility of stock prices and the lower duration that is found for cycles in stock prices we use a modified rule where a turning point is declared if the observation on each side of the peak (trough) is lower (higher) than the candidate turning point.

Once turning points are identified we inspect each expansion (defined as the period from a trough to the next peak) to see if it fits our definition of an asset price boom. To identify asset price booms we take a “holistic” approach. That is we first look for expansions that meet our criteria and then we visually inspect each prospective boom to check whether the dates for the boom should be corrected. For example, starting dates are moved to the point where the gradient of the asset price series first significantly picks up if the initial periods of the expansion are relatively flat.

The definition of a boom that we use is that a boom is a sustained expansion in asset prices that ends in a significant correction. For an expansion to meet the definition of a sustained expansion the expansion must last at least two years and average at least 5% per year for real

house and commodity prices and average at least 10% per year for real stock prices. The definition used is in accordance to the criteria used in Bordo and Wheelock (2009). The second screening that we use is that the price correction that follows the expansion in prices must be greater than 25% of the expansion in price that occurred during the preceding expansion. We believe that this definition rules out secular trends where there can be large increases in asset prices followed by small corrections followed by another large expansion. The booms that we identify all are followed by significant price corrections which suggest that the price expansion was not sustainable.

The identified asset prices booms are reported in Tables 1, 2 and 3. We have annual data on real house prices, real stock prices for 18 countries from 1920 to 2010. We also have a real global commodity price index for that period. See the data appendix. The approach we follow is similar to that used in IMF WEO (2003), Helbling and Terrones (2004) and Bordo and Wheelock (2009). All of these studies used monthly data for a smaller set of countries. Only the Bordo and Wheelock study covered the pre-World War II period. As in the earlier studies we identify many more stock price booms than house price booms.

IV.1 Housing Booms

With the exception of France in the 1930s and the U.S. in the 1920s in Table 1 we did not identify any house price booms before World War II . In the post-World War II period most countries had house price booms in the 1970s and 1980s. The literature at the time associated them with the liberalization of financial markets that occurred after the breakdown of the Bretton

Table 1: Identified Real House Price Booms

	Booms				Corrections			
	Period	Duration	% Δ	APC	Period	Duration	% Δ	APC
Belgium	1971-1979	8	58.9	7.36	1979-1985	6	-37.06	-6.18
Canada	1984-1989	5	57.52	11.5	1989-1998	9	-14.39	-1.6
Denmark	1982-1986	4	53.08	13.27	1986-1990	4	-25.72	-6.43
	2003-2007	4	53.49	13.37	2007-2009	2	-19.24	-9.62
Finland	1947-1955	8	50.77	6.35	1955-1958	3	-19.81	-6.6
	1971-1974	3	14.42	4.81	1974-1979	5	-26.82	-5.36
	1986-1989	3	61.85	20.62	1989-1993	4	-45.79	-11.45
France	1930-1935	5	37.69	7.54	1935-1941	6	-47.15	-7.86
	1971-1980	9	36.74	4.08	1980-1984	4	-16.76	-4.19
	1985-1991	6	30.84	5.14	1991-1997	6	-16.03	-2.67
U.K.	1971-1973	2	59.27	29.64	1973-1997	24	13.49	0.56
	1977-1980	3	26.18	8.73	1980-1982	2	-10.17	-5.08
	1985-1989	4	67.18	16.8	1989-1993	4	-26.83	-6.71
Ireland	1976-1979	3	40.58	13.53	1979-1987	8	-21.54	-2.69
	1996-2007	11	194.53	17.68	2007-2011	4	-40.52	-10.13
Italy	1980-1981	1	24.02	24.02	1981-1985	4	-30.65	-7.66
	1988-1992	4	49.63	12.41	1992-1997	5	-27.58	-5.52
Japan	1986-1991	5	34.16	6.83	1991-1994	3	-12.98	-4.33
Netherlands	1958-1964	6	51.11	8.52	1964-1966	2	-27.51	-13.75
	1976-1978	2	36.09	18.05	1978-1985	7	-47.75	-6.82
New Zealand	1971-1974	3	66.96	22.32	1974-1980	6	-38.19	-6.37
Norway	1983-1986	3	50.29	16.76	1986-1992	6	-35.2	-5.87
Sweden	1974-1979	5	22.02	4.4	1979-1985	6	-36.92	-6.15
	1985-1990	5	36.71	7.34	1990-1993	3	-28.58	-9.53
Switzerland								

	1971-1973	2	21.2	10.6	1973-1976	3	-26.01	-8.67
	1983-1989	6	43.31	7.22	1989-1997	8	-36.61	-4.58
United States								
	1921-1925	4	19.12	4.78	1925-1932	7	-12.57	-1.8
	1976-1979	3	14.47	4.82	1979-1982	3	-12.74	-4.25
	1984-1989	5	18.76	3.75	1989-1993	4	-13.01	-3.25
	1997-2006	9	79.38	8.82	2006-2009	3	-33.09	-11.03
Notes: APC = annualized percentage change								

Woods system. Many of the boom-busts were dramatic, especially in Japan, the Scandinavian countries, Netherlands and Switzerland. The U.S. only experienced mild booms and corrections in that period. Several dramatic episodes occurred in the late 1990s and early 2000s. The U.S. housing boom of 1997-2006 when real prices rose by 79% and fell by 33% and the Irish boom of 1996-2007 when real prices rose by 195% and then fell by 40% really stand out.

IV.2 Stock Price Booms

Stock prices show considerably more volatility than house prices and many more booms and busts (See Table 2). In the pre-World War II period most countries had major stock market booms and busts. In the 1920s many countries had booms similar to that on Wall Street. The Wall Street boom saw real prices rising by 183% 1923-28 and collapsing by 63% 1928-1932. The U.S. was surpassed by Canada and Switzerland but Australia, Finland and Sweden were not far behind. This pattern of international concordance of stock prices is well known (Goetzman, Rouwenhorst and Li, 2000). The recovery from the Great Contraction in the mid-1930s also displayed some major booms, especially in Australia, Canada, Finland, the UK, Sweden, Switzerland and the U.S.

In the post-World War II era, booms reflecting Europe's recovery and catch up in the 1950s occurred in France, Italy and Switzerland. Japan also had a major boom in the 1950s. The Marshall Plan and the Dodge Plan may have been keen drivers of both rapid real growth and the rise in asset values in those years (Bordo and Wheelock 2009).

The next big wave of stock market booms occurred in the 1980s and especially the 1990s. The growth of the high tech industry led to dramatic booms in the U.S., U.K., Germany, Ireland Italy, Spain, Sweden and Switzerland.

As discussed in section III above, Table 3 shows the post Great Contraction commodity price boom in the mid-1930s. The boom in the 1970s associated with the oil price shocks and the Great Inflation is also evident. The last big boom in the 2000s associated with the rapid growth of emerging markets and expansionary monetary policy is also very visible in the table.

Table 2: Identified Real Stock Price Booms

	Booms				Corrections			
	Period	Duration	% Δ	APC	Period	Duration	% Δ	APC
Australia								
	1920-1928	8	128.67	16.08	1928-1930	2	-35.73	-17.87
	1930-1936	6	154.21	25.7	1935-1941	5	-30.93	-6.19
	1956-1959	3	65.71	21.9	1959-1960	1	-15.02	-15.02
	1966-1969	3	79.3	26.43	1969-1971	2	-31.71	-15.85
	1978-1980	2	61.93	30.96	1980-1982	2	-44.92	-22.46
	2002-2007	5	88.03	17.61	2007-2008	1	-45.04	-45.04
Belgium								
	1987-1989	2	58.41	29.2	1989-1990	1	-28.21	-28.21
	1994-1998	4	141.32	35.33	1998-2002	4	-44.69	-11.17
	2002-2006	4	115.02	28.75	2006-2008	2	-53.95	-26.97
Canada								
	1920-1928	8	269.07	33.63	1928-1932	4	-64.99	-16.25
	1932-1936	4	146.19	36.55	1936-1937	1	-23.19	-23.19
	1953-1956	3	67.9	22.63	1956-1957	1	-24.81	-24.81
	1977-1980	3	61.95	20.65	1980-1982	2	-29.57	-14.79
	1998-2000	2	30.08	15.04	2000-2002	2	-29.22	-14.61
	2002-2007	5	88.93	17.79	2007-2008	1	-35.77	-35.77
Denmark								
	1932-1936	4	43.24	10.81	1936-1940	4	-42.37	-10.59
	1952-1956	4	32.81	8.2	1956-1957	1	-13.46	-13.46
	1957-1960	3	33.99	11.33	1960-1962	2	-11.88	-5.94
	1987-1989	2	81.72	40.86	1989-1992	3	-31.93	-10.64
	1998-2000	6	127.32	21.22	2000-2002	2	-35.79	-17.9
	2002-2007	5	145.41	29.08	2007-2008	1	-50.17	-50.17
Finland								
	1924-1927	3	154.64	51.55	1927-1929	2	-30.12	-15.06
	1932-1936	4	115.41	28.85	1936-1940	4	-35.82	-8.96
	1952-1956	4	87.27	21.82	1956-1958	2	-40.76	-20.38
	1969-1973	4	1531.34	382.83	1973-1977	4	-68.6	-17.15
	1985-1988	3	176.55	58.85	1988-1991	3	-63.41	-21.14
	1995-1999	4	704.66	176.17	1999-2002	3	-62.93	-20.98
	2004-2007	3	75.7	25.23	2007-2008	1	-54.95	-54.95
France								
	1920-1923	3	82.56	27.52	1923-1926	3	-28.59	-9.53
	1926-1928	2	109.19	54.59	1928-1931	3	-51.04	-17.01
	1950-1957	7	241.61	34.52	1957-1958	1	-21.13	-21.13
	1958-1962	4	76.66	19.17	1962-1967	5	-44.34	-8.87

	1977-1979	2	39.84	19.92	1979-1982	3	-31.33	-10.44
	1982-1986	4	218.43	54.61	1986-1987	1	-31.57	-31.57
	1987-1989	2	84.78	42.39	1989-1990	1	-27.72	-27.72
	1995-1999	4	195.91	48.98	1999-2002	3	-48.85	-16.28
	2002-2007	4	78.47	19.62	2007-2009	2	-44.86	-22.43
U.K.								
	1920-1928	8	41.11	5.14	1928-1931	3	-35.11	-11.7
	1931-1936	5	73.77	14.75	1936-1940	4	-53.24	-13.31
	1952-1954	2	47.91	23.96	1954-1857	3	-21.08	-7.03
	1957-1959	2	87.9	43.95	1959-1962	3	-16.48	-5.49
	1966-1968	2	70.35	35.17	1968-1970	2	-30.58	-15.29
	1970-1972	2	36.77	18.38	1972-1974	2	-76.72	-38.36
	1990-1999	9	143.86	15.98	1999-2002	3	-45.25	-15.08
	2002-2006	4	49.8	12.45	2006-2008	2	-34.7	-17.35
Germany								
	1956-1960	4	231.36	57.84	1960-1968	2	-34.69	-17.34
	1966-1969	3	64.14	21.38	1969-1971	2	-27.79	-13.9
	1981-1986	5	180.19	36.04	1986-1987	1	-37.81	-37.81
	1987-1989	2	65.88	32.94	1989-1992	3	-29.3	-9.77
	1992-1999	7	189.84	27.12	1999-2002	3	-59.73	-19.91
	2002-2007	5	130.96	26.19	2007-2008	1	-44.98	-44.98
Ireland								
	1957-1968	11	248.42	22.58	1968-1970	2	-33.05	-16.52
	1976-1978	2	106.51	53.25	1978-1982	4	-58.36	-14.59
	1982-1989	7	303.94	43.42	1989-1990	1	-33.33	-33.33
	1992-2000	8	279.45	34.93	2000-2002	2	-36.21	-18.11
	2002-2006	4	109.43	27.36	2006-2008	2	-76.48	-38.24
Italy								
	1922-1924	2	59.29	29.64	1924-1926	2	-44.26	-22.13
	1926-1928	2	65.13	32.57	1928-1932	4	-50.07	-12.52
	1956-1960	4	140.27	35.07	1960-1964	4	-53.85	-13.46
	1977-1980	3	92.61	30.87	1980-1982	2	-29.77	-14.89
	1982-1986	4	212.07	53.02	1986-1987	1	-35.78	-35.78
	1987-1989	2	25.67	12.84	1989-1992	3	-45	-15.00
	1995-2000	5	190.82	38.16	2000-2002	2	-46.2	-23.10
	2002-2006	4	68.33	17.08	2006-2008	2	-55	-27.50
Japan								
	1923-1926	3	43.2	14.40	1926-1930	4	-16.49	-4.12
	1931-1933	2	89.73	44.87	1933-1938	5	-30.73	-6.15
	1957-1960	3	169.68	56.56	1960-1963	3	-25.68	-8.56
	1967-1969	2	66.51	33.26	1969-1970	1	-22.05	-22.05
	1970-1972	2	136.21	68.10	1972-1974	2	-48.76	-24.38
	1977-1989	12	479.01	39.92	1989-1992	3	-59.64	-19.88

	2001-2006	4	101.39	25.35	2006-2008	2	-49.13	-24.56
Netherlands								
	1924-1928	4	41.18	10.30	1928-1931	3	-62.06	-20.69
	1951-1955	4	119.73	29.93	1955-1956	1	-18.80	-18.80
	1956-1959	3	71.87	23.96	1959-1961	2	-14.00	-7.00
	1965-1967	2	56.05	28.02	1967-1970	3	-38.24	-12.75
	1993-1998	5	203.19	40.64	1998-2001	3	-54.89	-18.3
	2001-2006	5	57.64	11.53	2006-2007	1	-52.68	-52.68
New Zealand								
	1931-1934	3	52.51	17.50	1934-1938	4	-28.15	-7.04
	1958-1964	6	117.6	19.60	1964-1966	2	-16.12	-8.06
	1967-1969	2	47.54	23.77	1969-1971	2	-27.91	-13.95
	1979-1981	2	45.44	22.72	1981-1982	1	-28.34	-28.34
	1982-1986	4	324.35	81.09	1986-1988	2	-61.76	-30.88
Norway								
	1921-1929	8	70.84	8.85	1929-1937	8	-41.47	5.18
	1953-1956	3	36.23	12.08	1956-1958	2	-26.25	-13.12
	1967-1970	3	69.70	23.23	1971-1971	1	-28.42	-28.42
	1971-1973	2	37.59	18.79	1973-1975	2	-54.25	-27.12
	2002-2007	5	231.3	46.26	2007-2008	1	-55.44	-55.44
	2008-2010	2	76.58	38.29	2010-2011	1	-15.49	-15.49
Spain								
	1950-1956	6	163.74	27.29	1956-1959	3	-48.60	-16.20
	1961-1963	2	31.47	15.73	1963-1964	1	-13.87	-13.87
	1967-1972	5	112.35	22.47	1972-1982	10	-91.31	-9.13
	1982-1989	7	294.4	42.06	1989-1992	3	-38.81	-12.94
	1994-1999	5	208.7	41.74	1999-2002	3	-43.39	-14.46
	2002-2007	5	120.31	24.06	2007-2008	1	-41.40	-41.40
Sweden								
	1923-1928	5	177.56	35.51	1928-1932	4	-62.81	-15.70
	1932-1936	4	102.71	25.68	1926-1941	5	-35.40	-7.08
	1958-1950	2	29.61	14.8	1950-1952	2	-19.58	-9.79
	1952-1954	2	47.97	23.98	1954-1957	3	-17.92	-5.97
	1957-1959	2	58.37	29.18	1959-1962	3	-17.90	-5.97
	1962-1965	3	36.16	12.05	1965-1966	1	-26.52	-26.52
	1970-1972	2	17.60	8.80	1972-1974	2	-18.40	-9.20
	1979-1989	10	503.68	50.37	1989-1990	1	-37.86	-37.86
	1992-1999	7	443.67	63.38	1999-2002	3	-56.63	-18.88
	2002-2006	4	141.66	35.42	2006-2008	2	-48.28	-24.14
	2008-2010	2	74.64	37.32	2010-2011	1	-18.09	-18.09
Switzerland								
	1920-1928	8	214.08	26.76	1928-1931	3	-46.72	-15.57
	1935-1938	3	88.88	29.63	1938-1940	2	-35.94	-17.97

1957-1961	4	187.92	46.98	1961-1966	5	-67.27	-13.45
1990-2000	10	342.77	34.28	2000-2002	2	-44.58	-22.29
2002-2006	4	91.21	22.8	2006-2008	2	-38.88	-19.44
United States							
1923-1928	5	182.59	36.52	1928-1932	4	-63.07	-15.77
1934-1936	2	73.15	36.57	1936-1937	1	-40.34	-40.34
1953-1956	3	83.34	27.78	1956-1957	1	-16.73	-16.73
1962-1965	3	40.03	13.34	1965-1966	1	-16.00	-16.00
1966-1968	2	19.82	9.91	1968-1970	2	-20.86	-10.43
1970-1972	2	19.97	9.98	1972-1974	2	-52.44	-26.22
1994-1999	5	184.55	36.91	1999-2002	3	-44.29	-14.76

Notes: APC=annualized percentage change.

Table 3: Identified Real Commodity Price Booms

Period	Booms			Period	Corrections		
	Duration	%Δ	APC		Duration	%Δ	APC
1933-1938	5	88.86	17.77	1938-1940	2	-17.7	-8.85
1950-1952	2	38.11	19.06	1952-1954	2	-22.98	-11.49
1963-1967	4	27.52	6.88	1967-1969	2	-19.56	-9.78
1972-1975	3	141.94	47.31	1975-1976	1	-13.23	-13.23
1976-1981	5	113.44	22.69	1981-1983	2	-24.74	-12.37
1986-1989	3	53.3	17.77	1989-1992	3	-24.96	-8.32
1994-1996	2	35.62	17.81	1996-2000	4	-28.96	-7.24
2002-2009	7	139.08	19.87	2009-2010	1	-19.71	-19.71

Notes: APC=annualized percentage change.

V. Empirical Analysis

In this analysis we pool data from across the 18 countries in our data set to investigate the impact of loose monetary policy and low nominal interest rates on asset prices.⁶ Low nominal interest

⁶ The countries in our sample are Australia, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and the USA. Countries are

rates could reflect the credibility for low inflation that occurred in the 1980s and 1990s and 1920s according to Borio and Lowe (2002) and Eichengreen and Michener (2004). In this environment, endogenous asset price booms could arise, financed by easy credit, accommodated by the central bank. Loose monetary policy refers to deliberately expansionary monetary policy (as evidenced in the policy rate being below the Taylor rule rate) done for example to prevent deflation as in the 2000s or to stimulate recovery from a recession.

The asset price data that we use in the analysis are real house prices, real stock prices, and real commodity prices. We include two different measures of monetary policy – the deviation of a short term interest rate from the optimal Taylor rule rate and the deviation of the money growth rate from 3%. The optimal Taylor rule rate is given by the following equation:

$$r^{Taylor} = \pi_t + r^* + 0.5(y_t - y_t^*) + 0.5(\pi_t - \pi^*) \quad (1)$$

where the output gap term is given by the deviation in log real GDP from its long run trend (as determined by the Hodrick-Prescott filter with a smoothing parameter equal to 100) and the inflation target is 2%. It should be noted that we do not use policy rates in this analysis and that we use for all countries a target interest rate (r^*) of 2% with coefficients of 0.5 and 0.5 that were chosen originally to fit US data for the 1990s. Thus the optimal Taylor rule rate that we use is a very rough measure of the optimal policy rate for each country.⁷ The same goes for our measure of monetary policy using the growth rate of broad money. We use the deviation of the growth

included in our regressions if data is available. When the number of countries reported for a regression is less than 18 it is because data for a country is missing.

⁷ As we collect more data, in particular data on policy rates, we will check the sensitivity of our results to this rough measure of the optimal policy rate.

rate of money from 3% as a simple measure of the stance of monetary policy present at the time. It also represents Milton Friedman's original (1960) monetary rule – to set money growth equal to the underlying trend growth rate of real output.⁸ If we assume the trend growth rate in velocity is constant, this rule would give stable prices.⁹ Money growth is also a useful measure of the stance of monetary policy in earlier periods when central banks engaged in monetary targeting or in episodes when it is more difficult to estimate a Taylor rule

The controls that we use in the regressions are, for each country where available, a short term interest rate, a measure of credit conditions in each economy – measured as the total number of bank loans as a proportion of GDP, the growth rate of real GDP, a measure of financial liberalization, and a measure of current account imbalances (exports less imports divided by GDP).¹⁰

In order to make all variables stationary we use deviations from a long run trend for the short term interest rate, the credit variable, and the current account variable, while we use first differences for the financial liberalization variable.¹¹ The growth rate of broad money and real GDP are already in first differences so those variables are left as is.

For the variables that we use in deviation from long run trend form we compute the long run trend using the HP-filter with a smoothing parameter set to 100 since our data is at the annual frequency. These variables are negative when the value is below the long-run trend and positive

⁸ The trend growth rate of real output would roughly hold for the U.S.1920-2010 but may be too high for some countries like the UK and too low for others.

⁹ Over the 1920-2010 period the trend growth rate of velocity was close to zero, averaging a decline to the 1960s and an increase since (Bordo and Jonung 1987).

¹⁰ See the Data Appendix for a description of the sources for the data used in this analysis.

¹¹ In order to make the current account variable stationary we use deviations from its long-run (HP) trend. Thus if the deviation is negative the current account has worsened relative to its recent past and if the value of this gap is positive the current account has improved relative to its recent past. A positive value does not necessarily mean the current account is in surplus and a negative value does not necessarily mean the current account is in deficit.

when the variable is above the long run trend. Our regression analysis then investigates the relationship between the deviation from the long run trend of asset prices and the deviation of short term interest rates from their long term trend and the deviation of the short term interest rate from the “optimal” Taylor rule rate (or deviation of the growth rate of money from 3% in the case where we use money growth rates in our regression). When the short term interest rate is below its long term trend then, at least locally, it is low and should feed into asset prices. When the short term rate is below the “optimal” Taylor rule rate then the monetary policy conditions are “loose”. We include both variables into the regression with lags in order to investigate the dynamic structure of low interest rates or loose monetary policy on asset prices. In determining the number of lags to include of each variable in our regression equation sequential likelihood ratio tests are used.

Finally, control variables such as credit conditions, the growth rate of real GDP, current account imbalances and a measure of financial liberalization are included into the regression equation. Tables 4, 5 and 6 show the results for real house prices, real stock prices and real commodity prices for each of the monetary variables respectively. The first two regressions are panel regressions and in these two regression equations country specific fixed effects are included. For the regression for real commodity prices, because the market for commodities is a global market, lacking measures of global monetary policy, we use US data as covariates.

V.1 Real House Prices

Table 4a and 4b report the results from our panel regressions where real house prices are the dependent variable. In all tables the numbers in parentheses are p-values. Country specific fixed effects are included but their estimates are not reported for space considerations.

Table 4a reports the results when the deviation from the optimal Taylor rule interest rate is used as a measure of the current monetary conditions in the economy. Using sequential likelihood ratio tests it was concluded that only the current level of the deviation of the short term interest rate from the optimal Taylor-rule rate should be included in the model. However, the current level of the short term interest rate and 4 lags are included. The interest rate is included as a deviation from its long-run (HP) trend.

The first result that we find is that the coefficient on the monetary policy measure (deviation of the short term interest rate from the Taylor-rule rate) is negative and significant. That is when the short term interest rate is below the optimal rate suggested by the Taylor rule given in (1), there is positive pressure on real house prices. This result is consistent even when we control for the interest rate (as measured as a deviation from its long-run trend) and other control variables described above. The coefficient on the current level of the interest rate deviated from its long-run trend is positive and significant. This is surprising and counter-intuitive but the coefficients on the 3rd and 4th lag of the deviation of the interest rate from its long-run trend are large and negative. This suggests that low interest rates (relative to their recent history) positively affect real house prices with a lag of 3 to 4 years. An important result that can be taken from these results is that even when we account for the level of the interest rate the measure of current monetary policy still has an effect.

Table 4a: Regression Results for Real House Prices (Taylor Rule)*Dependent Variable: Deviation of real house prices from their long-run trend (HP trend)*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$(r - r^{Taylor})_t$	-0.09** (0.02)	-0.27*** (0.00)	-0.30*** (0.00)	-0.24*** (0.01)	-0.24*** (0.01)	-0.33*** (0.00)
$(r - r^{LR})_t$		0.89*** (0.00)	0.86*** (0.00)	0.76*** (0.01)	0.74*** (0.01)	0.58* (0.06)
$(r - r^{LR})_{t-1}$		-0.46* (0.07)	-0.44* (0.07)	-0.08 (0.80)	0.19 (0.57)	0.10 (0.78)
$(r - r^{LR})_{t-2}$		-0.45* (0.08)	-0.40 (0.10)	-0.39 (0.19)	-0.43 (0.15)	-0.39 (0.20)
$(r - r^{LR})_{t-3}$		-0.59** (0.02)	-0.59*** (0.01)	-0.67** (0.02)	-0.67** (0.02)	-0.66** (0.02)
$(r - r^{LR})_{t-4}$		-0.68*** (0.00)	-0.62*** (0.00)	-0.70*** (0.01)	-0.70*** (0.01)	-0.81*** (0.00)
Credit			0.34*** (0.00)	0.24*** (0.00)	0.26*** (0.00)	0.20*** (0.01)
Current Account				-0.02*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)
GDP Growth					0.01* (0.06)	0.00 (0.17)
Δ Financial Liberalization						0.00 (0.41)
Number of Observations		593	554	330	330	276
Number of Countries		15	14	10	10	9
R^2		0.15	0.21	0.3	0.31	0.3
\bar{R}^2		0.12	0.18	0.26	0.27	0.25

Note: Fixed effects included. Results not reported. Numbers in parentheses are p-values.

Other results that are interesting are the consistently positive and significant impact that the credit variable (in this case measured as the total number of loans outstanding as a proportion

of GDP) on real house prices. As credit expands so will a house price boom inflate consistent with the story in Jorda, Schularick and Taylor (2012). The deviation of the current account from its long-term (HP) trend is significant and negative while the growth rate of real GDP is significant and positive. The financial liberalization variable does not have any impact.¹² One interpretation of the negative coefficient for the current account variable is that as the current account worsens relative to its long-run trend inward capital flows have a positive impact on real house prices.

Table 4b reports the same regression results except this time the deviation of money growth (broad money) is used as our measure of expansionary monetary policy instead of the deviation of the short term interest rate from the optimal Taylor-rule rate. In this regression it was determined that 3 lags of the policy variable should be included and 4 lags of the interest rate deviated from its trend should be included in the regression. The results for the policy variable are not as strong as in Table 4a. The coefficients on the first and second lag of the money growth variable are significant and positive but not for all versions of the regression.¹³ Regression (4) would be the preferred specification in that higher growth rate of money would feed into house prices with a lag. As before, an expansion of credit has a positive effect on house prices and a lower than normal current account has a negative impact on house prices. Again, financial liberalization does not play an important role in the determination of house prices.

¹² Data for the financial liberalization variable is only available from 1970 onwards so this regression only includes data after 1970.

¹³ Note that a money growth rate above 3% indicates monetary ease so a positive coefficient indicates that monetary ease has a positive impact on house prices.

Table 4b: Regression Results for Real House Prices (Money Growth Rate)*Dependent Variable: Deviation of real house prices from their long-run trend (HP trend)*

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$(\Delta \log(m) - 0.03)_t$	-0.01 (0.90)	-0.01 (0.89)	0.01 (0.92)	0.08 (0.40)	0.21 (0.09)	0.16 (0.21)
$(\Delta \log(m) - 0.03)_{t-1}$	0.20** (0.01)	0.20** (0.01)	0.18** (0.02)	0.18 (0.11)	0.13 (0.34)	0.13 (0.35)
$(\Delta \log(m) - 0.03)_{t-2}$	0.18** (0.01)	0.18** (0.01)	0.17** (0.02)	0.19* (0.05)	0.11 (0.35)	0.16 (0.18)
$(r - r^{LR})_t$		0.74*** (0.00)	0.70*** (0.00)	0.66** (0.01)	0.56* (0.06)	0.38 (0.21)
$(r - r^{LR})_{t-1}$		-0.52** (0.03)	-0.46* (0.05)	-0.31 (0.25)	0.01 (0.98)	-0.07 (0.84)
$(r - r^{LR})_{t-2}$		-0.67** (0.01)	-0.60** (0.01)	-0.56** (0.03)	-0.55* (0.07)	-0.57* (0.07)
$(r - r^{LR})_{t-3}$		-0.72*** (0.00)	-0.68*** (0.00)	-0.75*** (0.00)	-0.77** (0.01)	-0.77** (0.01)
$(r - r^{LR})_{t-4}$		-0.80*** (0.00)	-0.76*** (0.00)	-0.73*** (0.00)	-0.81*** (0.00)	-0.94*** (0.00)
Credit			0.33*** (0.00)	0.33*** (0.00)	0.25*** (0.00)	0.18** (0.02)
Current Account				-0.02*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)
GDP Growth					0.00 (0.18)	0.00 (0.23)
Δ Financial Liberalization						0.00 (0.46)
Number of Observations	808	585.00	582	482	330	276
Number of Countries	14	14.00	14	12	10	9
R^2	0.02	0.18	0.23	0.26	0.32	0.31
\bar{R}^2	0	0.15	0.2	0.23	0.28	0.26

Note: Constant included in regression. Results not reported. Numbers in parentheses are p-values.

One reason for why there might be differences between the two approaches is that some of the bigger booms occurred in the late 1980s and early 1990s, in a period when the use of interest rates became more prevalent than money growth rates as policy instruments for the countries in our sample. This is obviously only speculation but does warrant further investigation.

V.2 Real Stock Prices

Tables 5a and 5b repeat the analysis for real stock prices. In Table 5a the deviation of the interest rate from the optimal Taylor-rule rate is included in the regression with its first lag. Current and two lags of the interest rate relative to its long-run mean are also included. The results here are not as favorable for a monetary policy explanation since the coefficient on the monetary policy variable is not always significant and when it is, it has the wrong sign. These results are remarkably robust across different time periods. Each country was dropped from the sample to check for outliers but in all cases the coefficients were positive and sometimes significant.

The results for the measure of the level of the interest rate (its deviation from its long-run mean) are much stronger. The coefficients on the current level and the first two lags of the deviation of the interest rate are negative and significant. Thus when interest rates are low relative to their recent history (as opposed to low relative to the optimal Taylor-rule rate) there is a positive impact on stock prices. The fact that the two lags are also significant and negative suggests that long periods of low interest rates could be a contributing factor for stock market booms.

Table 5a: Regression Results for Real Stock Prices (Taylor Rule)*Dependent Variable: Deviation of real stock prices from their long-run trend (HP trend)*

	(1)	(2)	(3)	(4)	(5)	(6)
$(r - r^{Taylor})_t$	-0.26** (0.03)	-0.02 (0.92)	0.22 (0.36)	0.45 (0.22)	0.64* (0.09)	0.81* (0.07)
$(r - r^{Taylor})_{t-1}$	0.43*** (0.00)	0.66*** (0.00)	0.79*** (0.00)	0.55 (0.13)	0.37 (0.31)	0.40 (0.34)
$(r - r^{LR})_t$		-2.49*** (0.00)	-2.70*** (0.00)	-2.77*** (0.00)	-3.02*** (0.00)	-3.27*** (0.00)
$(r - r^{LR})_{t-1}$		-1.44*** (0.01)	-1.63*** (0.00)	-1.90*** (0.01)	-1.02 (0.20)	-1.10 (0.20)
$(r - r^{LR})_{t-2}$		-2.21*** (0.00)	-2.19*** (0.00)	-2.88*** (0.00)	-3.02*** (0.00)	-3.27*** (0.00)
Credit			0.30** (0.02)	0.26 (0.15)	0.37** (0.05)	0.36* (0.06)
Current Account				0.01* (0.08)	0.02** (0.05)	0.01 (0.20)
GDP Growth					0.02*** (0.01)	0.02** (0.02)
Δ Financial Liberalization						0.01 (0.44)
Number of Observations		692	616	339	339	280
Number of Countries		15	14	10	10	9
R^2		0.14	0.2	0.21	0.23	0.26
\bar{R}^2		0.11	0.17	0.17	0.19	0.21

Note: Fixed effects included. Results not reported. Numbers in parentheses are p-values.

The results on the other control variables are also consistent with expectations. An increase in credit leads to a positive impact on stock prices as does an increase in the growth rate of real GDP. Higher than normal levels of the current account lead to higher stock prices and this

is in contrast to the house price results. When the current account improves, relative to its recent history, there could be two competing factors here. Capital flows out but if the improvement of the current account is due to an export boom then this could be reflected in stock prices. These countervailing forces would not be present in the prices for houses which could be a reason for the differences we find here.

Table 5b reports the results when the growth rate of broad money is used in place of the deviation of the interest rate from the policy rate. The results here show some evidence that loose monetary policy could have an impact on real stock prices with significant and positive coefficients. However the results are not consistent in that the deviation of the growth rate of broad money from 3% has a positive effect on stock prices contemporaneously but a negative effect with a lag. The measure of the interest rate from its long-run mean is significant and negative, although in this regression the impact from the lagged values do not appear. Again relaxing credit has a significant and positive impact as does higher than usual current account levels. This time however the growth rate of real GDP does not play a significant role.

So there is some evidence that loose monetary policy impacts stock prices but this evidence is tenuous at best. There is strong robust evidence that increasing credit and low interest rates play important roles in determining stock prices.

Table 5b: Regression Results for Real Stock Prices (Money Growth Rule)*Dependent Variable: Deviation of real stock prices from their long-run trend (HP trend)*

	(1)	(2)	(3)	(4)	(5)	(6)
$(\Delta \log(m) - 0.03)_t$	0.72*** (0.00)	0.54*** (0.00)	0.48** (0.01)	0.91*** (0.00)	0.72** (0.01)	0.38 (0.24)
$(\Delta \log(m) - 0.03)_{t-1}$	-0.09 (0.57)	-0.20 (0.27)	-0.30 (0.10)	-0.86** (0.01)	-0.83** (0.01)	-0.88** (0.01)
$(\Delta \log(m) - 0.03)_{t-2}$	-0.49*** (0.00)	-0.43** (0.01)	-0.41** (0.02)	-0.88*** (0.00)	-0.77** (0.01)	-0.47 (0.14)
$(r - r^{LR})_t$		-3.34*** (0.00)	-3.28*** (0.00)	-3.05*** (0.00)	-2.88*** (0.00)	-3.41*** (0.00)
Credit Gap			0.53*** (0.00)	0.45** (0.02)	0.58*** (0.00)	0.56** (0.01)
Current Account				0.00 (0.94)	0.02*** (0.00)	0.02*** (0.00)
GDP Growth					0.01 (0.46)	0.00 (0.73)
Δ Financial Liberalization						0.01 (0.43)
Number of Observations	963	696	659	363	343	281
Number of Countries	14	14	14	10	10	9
R^2	0.04	0.09	0.12	0.15	0.19	0.19
\bar{R}^2	0.02	0.07	0.09	0.11	0.15	0.14

Note: Constant included in regression. Results not reported. Numbers in parentheses are p-values.

V.3 Real Commodity Prices

Tables 6a and 6b report results for real commodity prices. Because of the global nature of the commodity price market in lieu of global monetary policy measures we use US data in these regressions. Table 6a reports the results when we use the deviation of the interest rate rule from

Table 6a: Regression Results for Real Commodity Prices (Taylor Rule)

Dependent Variable: Deviation of real commodity prices from their long-run trend (HP trend)

	(1)	(2)	(3)	(4)	(5)	(6)
$(r - r^{Taylor})_t$	-0.73*** (0.00)	-0.23 (0.32)	-0.79* (0.06)	-0.24 (0.66)	-0.33 (0.60)	-0.48 (0.45)
$(r - r^*)_t$		5.06*** (0.00)	4.23*** (0.00)	4.61*** (0.00)	4.53*** (0.00)	3.71*** (0.01)
$(r - r^*)_{t-1}$		-3.86*** (0.00)	-3.16*** (0.01)	-5.25*** (0.00)	-4.95*** (0.00)	-4.61** (0.01)
Credit			0.71 (0.13)	0.97* (0.08)	0.98* (0.08)	1.42** (0.05)
Current Account				0.10*** (0.00)	0.10*** (0.00)	0.11*** (0.00)
GDP Growth					0.00 (0.77)	0.01 (0.34)
Δ Financial Liberalization						0.03 (0.29)
Number of Observations	84	65	59	37	37	32
Number of Countries	1	1	1	1	1	1
R^2	0.19	0.31	0.37	0.62	0.62	0.52
\bar{R}^2	0.18	0.28	0.32	0.56	0.54	0.51

Note: Constant included in regression. Results not reported. Numbers in parentheses are p-values.

the optimal Taylor-rate. For real commodity prices we find that loose US monetary policy significantly impacts commodity prices for some of the specifications. The coefficient on the policy variable is consistently negative but not always significant. We also find the low interest rates (at least lower than average) impact real commodity prices. An increase in credit and a higher than average current account also has a positive impacts on commodity prices. These results are robust to specification.

Table 6b: Regression Results for Real Commodity Prices (Taylor Rule)

Dependent Variable: Deviation of real commodity prices from their long-run trend (HP trend)

	(1)	(2)	(3)	(4)	(5)	(6)
$(\Delta \log(m) - 0.03)_t$	0.52** (0.03)	-0.10 (0.76)	-0.09 (0.86)	0.75 (0.20)	0.82 (0.19)	1.49** (0.02)
$(r - r^*)_t$		4.63*** (0.00)	3.93*** (0.00)	4.45*** (0.00)	5.16*** (0.00)	4.58*** (0.00)
$(r - r^*)_{t-1}$		-3.12** (0.01)	-2.82** (0.02)	-5.72*** (0.00)	-6.53*** (0.00)	-7.18*** (0.00)
Credit			0.96* (0.06)	1.38** (0.01)	1.00* (0.07)	1.56** (0.02)
Current Account				0.12*** (0.00)	0.11*** (0.00)	0.12*** (0.00)
GDP Growth					-0.01 (0.65)	0.00 (0.91)
Δ Financial Liberalization						0.03 (0.27)
Number of Observations	89	67	61	39	37	32
Number of Countries	1	1	1	1	1	1
R^2	0.05	0.24	0.29	0.61	0.64	0.69
\bar{R}^2	0.04	0.2	0.2	0.56	0.56	0.6

Note: Constant included in regression. Results not reported. Numbers in parentheses are p-values.

We get similar results when we use the money growth variable in place of the interest rate variable (Table 6b) but for the preferred specification (equation (6)) the coefficient on excess growth of money is significant and positive. Again credit and the current account have a positive effect on real commodity prices.

Our regression results suggest that loose monetary policy, even when accounting for relatively low interest rates, does have an impact on real asset prices with house prices and

commodity prices being the asset prices that are impacted the most. There is not clear evidence of a link between loose monetary policy and real stock prices but there is some evidence that loose monetary policy could play a role.

VI. Policy Lessons

Our evidence that loose monetary policy does contribute significantly to booms in house prices, commodity prices and somewhat less to booms in stock prices leads to the question about what central banks should do about it. Should they use their policy tools to target housing prices, stock prices or commodity prices directly? Or should they give an important weight to asset prices when setting their policy instruments as a possible contingency to depart from their core low inflation (high employment) targets? This subject received considerable attention during the tech boom of the late 1990s and again during the housing boom in the mid-2000s (Bordo and Wheelock 2009). Since periods of explosive growth in asset prices have often preceded financial crises and contractions in economic activity, some economists have argued that by defusing asset price booms, monetary policy can limit the adverse impact of financial instability on economic activity.

The likelihood of a price collapse and subsequent macroeconomic decline might, however, depend on why asset prices are rising in the first place. Many analysts believe that asset booms do not pose a threat to economic activity or the outlook for inflation so long as they can be justified by realistic prospects of future earnings growth in the case of stock prices or reflect real fundamentals such as population growth in the case of housing booms or real side shocks or

changing conditions of supply like natural disasters or demand (like the growth of China) in the case of commodity price booms.

On the other hand, if rising stock prices reflect “irrational exuberance” or rising house prices reflect a bubble, they may pose a threat to economic stability and justify a monetary policy response to encourage market participants to revalue equities more realistically or to deter speculation in real estate. In the case of commodity prices, to the extent a boom does not reflect fundamentals then policy tightening could defuse the real effects of a sudden bust.

The traditional view holds that monetary policy should react to asset price movements only to the extent that they provide information about future inflation. This view holds that monetary policy will contribute to financial stability by maintaining stability of the price level (Bordo et al 2002,2003, Schwartz 1995), and that financial imbalances or crises should be dealt with separately by regulatory or lender of last resort policies (Schwartz (2002). Bernanke and Gertler (1999, 2001) presented the traditional view in the context of a Taylor rule.

Many economists do not accept the traditional view, at least not entirely. Smets (1997), for example argued that monetary policy tightening is optimal in response in response to “irrational exuberance’ in financial markets. Similarly, Cecchetti, et al (2000) contended that monetary policy should react when asset prices become misaligned with fundamentals. Bernanke and Gertler (2001) expressed doubts that policymakers can judge reliably whether asset prices are being driven by ‘irrational exuberance”, or that an asset price collapse is imminent. Cecchetti (2003) replied, however, that asset price misalignments are no more difficult to identify than other components of the Taylor rule, such as potential output.¹⁴

¹⁴ For the debate within the FOMC over the 1990s stock market boom see Bordo and Wheelock (2004).

Bordo and Jeanne (2002a, 2002b) offered a different argument in support of a monetary policy response to asset price booms. They argued that preemptive actions to defuse an asset price boom can be regarded as insurance against the high cost of lost output should a bust occur. They contended that policy makers should attempt to contain asset price misalignments when the risk of a bust (or the consequences of a bust) are large, or when the cost of defusing a boom is low in terms of foregone output. Bordo and Jeanne showed that a tension exists between these two conditions. As investors become more exuberant, the risks associated with a reversal in market sentiment increases, but leaning against the wind of investor optimism requires more costly monetary actions. Thus the monetary authorities must evaluate both the probability of a costly crisis and the extent to which they can reduce this probability.

Since this earlier debate, where the warnings of Bordo and Jeanne and others were not largely heeded, the housing bust of 2006 in the U.S. and the subsequent financial crisis and Great Recession led many policy makers to decide that financial stability should be an important goal of central banks along with low inflation (and overall macro stability). The new view argued that central banks should be closely monitoring asset price developments and the state of the financial system (including non-banks and banks) and be willing to use policy to defuse threatening imbalances. This became known as the case for macro prudential regulation which promoted the use of policy tools such as countercyclical capital requirements and liquidity ratios (Kashyap Rajan and Stein 2008). This case, fostered by the BIS and many others, has led to important changes in the central banking and financial regulatory landscape including the 2010 Dodd Frank Bill in the U.S. which has given the Federal Reserve greatly expanded powers over the financial system as a whole, and in the UK where the Bank of England has taken over the responsibilities of the Financial Stability authority.

The question arises whether the new financial stability powers of central banks will work to prevent the next crisis? Also whether the new impetus has gone too far in encroaching on the traditional role of central banks to maintain price stability, act as lenders of last resort to the banking system and protectors of the integrity of the payments system. The history of financial regulation after big financial crises, e.g the Great Depression suggests that often the government overreacts and in the name of safety suppresses financial development and the price discovery mechanism of financial markets. The regime of the 1930s to 1970s gave us financial stability at the expense of unworkable firewalls between complementary financial functions (Glass Steagall) and price controls and ceilings like regulation Q in the U.S. and the prohibition of the payment of interest on demand deposits. Similar regulations were put in place across the world. These regulations and controls broke down in the face of the Great Inflation and financial market arbitrage and financial innovation. In addition in this immediate post World War II period central banks lost their independence to the fiscal authorities who had other, politically driven, objectives in mind. It would not be surprising if that happened again.

More fundamentally many of the recent institutional changes pose threats to the independence of central banks and their ability to perform their core mission which is to maintain the value of money (Bordo 2010, Svensson 2010). Central banks were also supposed to act as lenders of last resort—providing emergency liquidity-- to the banking system. They were not responsible for the solvency of banks or any other entities or the financing of government deficits (except in wartime) (Bordo 2012).

The bottom line is that asset price booms (stock market and housing market) are important, potentially dangerous to the real economy and should be closely monitored and possibly defused. However the policy tools to do this should not be the traditional tools of

monetary policy. Other tools such as margin requirements for stock prices, minimum down payments for housing and risk weighted, bank size weighted, capital requirements for banks could be used. Authorities other than central banks should preferably perform these tasks to prevent central banks from being diverted from their main functions.

To the extent that asset price booms including commodity price booms do not reflect real fundamentals they should also be viewed as harbingers of future inflation and as part of the normal transmission mechanism of monetary policy as did occur in earlier historical episodes. In this case they serve as a signal for tighter monetary policy.

Finally, our evidence for close to a century, for many countries, and for three types of asset booms, that expansionary monetary policy is a significant trigger, makes the case that central banks should follow stable monetary policies. These should be based on well understood and credible monetary rules.

References

- Rudiger Ahrend, Boris Courneade, Robert Price (2008), Monetary Policy, Market Excesses and Financial Turmoil” OECD *Economics Department Working Paper* No. 597
- Armen Alchian and Benjamin Klein (1973), “On a Correct Measure of Inflation” *Journal of Money, Credit and Banking*, February 5(1) Part 1, pp 173-191.
- Robert Barsky and Lutz Killian (2001), “Do we really know that oil caused the Great Stagflation? A Monetary Alternative,” in *NBER Macroeconomics Annual 2001*, Cambridge; MIT Press. pp 137-183.
- Ben Bernanke and Mark Gertler (1999) “Monetary Policy and Asset Volatility” *Economic Review, Federal Reserve Bank of Kansas City*, 1999, 84(4), pp 17-52.
- Ben Bernanke and Mark Gertler (2001) “Should Central Banks Respond to Movements in Asset Prices? “ *American Economic Review*, (192), pp 253-57.
- Michael Bordo (1980) “The Effects of Monetary Change on Relative Commodity Prices and the Role of Long-Term Contracts” *Journal of Political Economy*, December.
- Michael Bordo and Lars Jonung (1987), *The Long-run Behavior of the Velocity of Circulation: The International Evidence*. New York: Cambridge University Press.
- Michael Bordo (1998) “Commentary on Larry Neal,” The Financial Crisis of 1825 and the Reconstruction of the British Financial System” *Federal Reserve Bank of St. Louis Review* May /June.
- Michael Bordo and Olivier Jeanne (2002a) ‘Boom Bust in Asset Prices, Economic Instability, and Monetary Policy’ *NBER Working Paper* no. 8996 June

- Michael Bordo, Michael Dueker and David Wheelock (2002) “Aggregate Price Shocks and Financial Stability: A Historical Analysis” *Economic Inquiry*, October 40(4), pp 521-538.
- Michael Bordo , Michael Dueker and David Wheelock (2003) “ Aggregate Price Shocks and Financial Stability: The United Kingdom 1796- 1999” *Explorations in Economic History April* , 40(4), pp 143-169.
- Michael Bordo and Olivier Jeanne (2002b) “Monetary Policy and Asset Prices; Does ‘Benign Neglect’ Make Sense? *International Finance*, 5(2) pp 139-164.
- Michael Bordo (2003) “ Stock Market Crashes, Productivity Boom Busts and Recessions: some Historical Evidence” Chapter III *IMF World Economic Outlook April*
- Michael Bordo and David Wheelock (2004) “Monetary Policy and Asset Prices: A Look Back at Past U.S. Stock Market Booms” *NBER Working Paper* 10704 August.
- Michael Bordo (2010) “Long Term Perspectives on Central Banking” *Norges Bank Symposium* What is a *Useful Central Bank?*. November
- Michael Bordo (2012) “ Under what Circumstances Can Inflation Be a Solution to Excessive National Debt: Some Lessons from History? ” *Conference on Paper Money—State financing—Inflation*. Deutsche Bundesbank November.
- Michael Bordo and Efraim Benmelech(2008) “The Crisis of 1873 and the Failure of Corporate Governance” NBER DAE Summer Institute
- Michael Bordo and David Wheelock (2009) “ When Do Stock Market Booms Occur? The Macroeconomic and Policy of Twentieth Century Booms “ in Jeremy Atack and Larry

Neal (eds) *The Origins and Development of Financial Markets and Institutions*. New York:Cambridge University Press.

Alan Blinder and Jeremy Rudd (2008) “The Supply Shock Explanation of the Great Stagflation Revisited” *NBER Working paper* 14568

Claudio Borio and Philip Lowe (2002) “Asset Prices, Financial and Monetary Stability: Exploring the Nexus’ *BIS Working Paper* no.114.

Claudio Borio (2012) “The Financial Cycle and Macroeconomics: What have We Learnt?” *BIS (mimeo)* September

Karl Brunner and Allan Meltzer (1973), “Mr. Hicks and the ‘Monetarists’.” *Economica*. February 40(157) pp 44-59.

Frank Browne and David Cronin (2007)” ‘Commodity Prices and Inflation’ *ECB Working Paper* No. 738, March

G. Bry and C. Boschan (1971), *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*, NBER, New York.

Michael Bryan, Stephen Cecchetti and Roisin O’Sullivan, (2000), “ Asset Prices in the Measurement of Inflation” *National Bureau of Economic Research Working paper* No. 8700 January

Stephen G. Cecchetti, Hans Genberg, John Lipsky , and Sushil Wadhwani, (2000) “ Asset Prices and Central Bank Policy” *Geneva Reports on the World Economy* 2, International Center for Banking Studies and Centre for Economic Policy Research, July.

Stephen G. Cecchetti(2003) “ What the FOMC Says and Does When the Stock Market Booms”,
Conference on Asset Prices and Monetary Policy. Reserve Bank of Australia, Sydney,
August.

Matteo Ciccarelli and Benoit Mojon (2010) “Global Inflation” *Review of Economics and
Statistics*, August.

Tim Congdon(2005) *Money and Asset Prices in Boom and Bust*. Institute of Economic Affairs
London

Rudiger Dornbusch and Jacob Frenkel (1984), The Gold Standard and the Bank of England in
the Crisis of 1847” in Michael Bordo and Anna Schwartz (eds) *A Retrospective on the
Classical Gold Standard 1821-1931*. Chicago: University of Chicago Press for the
NBER pp 233-276.

Barry Eichengreen and Kris Mitchener (2004) “The Great Depression as a Credit Boom gone
Wrong” *Research in Economic History* Volume 22, 183-237.

Jeffrey Frankel (2008) “ The Effect of Monetary Policy on Real Commodity Prices’ in John
Campbell (ed) *Asset Prices and Monetary Policy*. Chicago; University of Chicago
press

Milton Friedman (1960) *A Program for Monetary Stability*. New York: Fordham University
Press

Milton Friedman and Anna Schwartz (1963a)’ Money and Business Cycles” *Review of
Economics and Statistics*. February 45b, pp 32-64

Milton Friedman and Anna Schwartz (1963b) *A Monetary History of the United States, 1867-
1960*. Princeton; Princeton University Press

- John Kenneth Galbraith (1955), *The Great Crash*, 1929. Boston: Houghton Mifflin.
- Stefan Gerlach and Katrin Assenmacher-Wesche. (2008a) “Financial Structure and the Impact of Monetary Policy on Asset Prices” *Swiss National Bank Working Paper* 2008-16.
- Stefan Gerlach and Katrin Assenmacher-Wesche (2008b) “Monetary Policy, Asset Prices and Macroeconomic conditions; A Panel VAR Study” *National Bank of Belgium Working Paper* 149
- Don Harding and Adrian Pagan (2002), “Dissecting the cycle: a methodological investigation,” *Journal of Monetary Economics* **49**, pp. 405—438.
- Christian Hott, Terhi Jokipii,(2012) “ Housing Bubbles and Interest Rates” *Swiss National Bank Working paper* 2012-07
- Tokuo Iwaisako and Takatoshi Ito (1995) “ Explaining Asset Bubbles in Japan” *NBER Working Paper* No. 5350
- Lars Jonung, Jaako Kiander and Pentti Vartia (2009), *The Great Financial Crisis in Finland and Sweden*. Edward Elgar publishers, Northampton, Mass
- Oscar Jorda, Moritz Schularick and Alan Taylor, (2012) “When Credit Bites Back: Leverage, Business Cycles and Crises”. *Journal of Money, Credit and Banking*, September
- David Laidler (2003) “The Price Level, Relative Prices, and Economic Stability; Aspects of the Interwar Debate” *BIS conference” Monetary Stability, Financial Stability and the Business Cycle”*.

- Ellen McGrattan and Edward Prescott (2003) “The 1929 Stock Market: Irving Fisher Was Right.” *Federal Reserve Bank of Minneapolis Research Department Staff Report* 294. May
- Lloyd Metzler (1951), “Wealth, Saving and the Rate of Interest’ *Journal of Political Economy*. April 5992) pp 93-116
- Larry Neal (1998) “The Financial Crisis of 1825 and the Reconstruction of the British Financial System” *Federal Reserve Bank of St. Louis Review* May/June.
- Larry Neal (2011) “I am Not Master of Events” *The Speculations of John Law and Lord Londonderry in the Mississippi and South Sea Bubbles*. New Haven. Yale University Press.
- Arthur Okun (1975) “Inflation: Its Mechanics and Welfare Costs.’ *Brookings Papers on Economic Activity* 2, pp 351-401.
- Adrian Pagan and Kirill Sossounov (2003), “A Simple Framework for Analysing Bull and Bear Markets,” *Journal of Applied Econometrics*, **18**, pp. 23—46.
- Patrizio Pagano, Marco Lombardi and Alessio Anzuini (2010). “ The Impact of Monetary Policy on Commodity prices. *ECB Working paper* 1232
- Peter Rapoport and Eugene White (1994) ‘Was the Crash of 1929 Expected?’” *American Economic Review*, March
- Murray Rothbard (1983) *America’s Great Depression. Fourth Edition*. New York: Richardson and Snyder

- Anna J. Schwartz (1995), “Why Financial Stability Depends on Price Stability.” *Economic Affairs*, pp 21-25.
- Anna J. Schwartz (2002) “ Asset Price Inflation and Monetary Policy.” *NBER Working paper* no. 9321.
- Erling Steigum (2009) “The Boom and Bust Cycle in Norway’ in Lars Jonung et al (eds) *The Great Financial Crisis in Finland and Sweden*. Edward Elgar publishers, Northampton, Mass. Pp 202-244.
- Frank Smets (1997), “Financial Asset Prices and Monetary Policy: Theory and Evidence” *BIS Working Paper* no.47, September.
- Lars Svernsen (2010) “ Where Do Central Banks go from here?” *Norges Bank Symposium. What is a Useful Central Bank* . November.
- John B. Taylor (1999) “A Historical Analysis of Monetary Policy Rules “in John B. Taylor (ed) *Monetary Policy Rules* Chicago: University of Chicago Press for the NBER. Pp 319-348.
- John B. Taylor (2007) “Housing and Monetary Policy” in *Housing, Housing Finance and Monetary Policy* Federal Reserve Bank of Kansas City.
- John B. Taylor (2009) *Getting Off Track*. Hoover Press. Stanford CA
- James Tobin (1969) ‘A General Equilibrium Approach to Monetary Theory’ *Journal of Money, Credit and Banking*, February, 1(1) , pp 15-29.
- Francois Velde (2003) “Government Equity and Money: John Law’s System in 1720” *Federal Reserve Bank of Chicago Working Paper* 2003-31.

George.F. Warren and Frank A. Pearson(1935) *Gold and Prices*. New York Wiley

Eugene White (2009) “ Lessons From the Great American Real Estate Boom and Bust of the 1920s” *NBER Working Paper* 15573 December

Michael Woodford (2003) *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton; Princeton University Press.

Appendix: Data Sources

Real GDP

See Michael D. Bordo, Christopher M. Meissner "Does Inequality Lead to a Financial Crisis?"
NBER Working Paper No. 17896

Real house price index, 2000=100.

Detailed description: US [*Robert J. Shiller, Irrational Exuberance, 2nd. Edition, Princeton University Press, 2005, 2009, Broadway Books 2006, also Subprime Solution, 2008, as updated by author*], Norway [*Norges Bank; Eitrheim, Ø. og Erlandsen, S. "Monetary aggregates in Norway 1819-2003", 349-376 Chapter 9 in Eitrheim, Ø., J.T. Klovland and J.F. Qvigstad (eds.), Historical Monetary Statistics for Norway 1819-2003, Norges Bank Occasional Papers no. 35, Oslo, 2004*], UK [*Department for Communities and Local Government, Housing statistics*], France [*conseil général de l'Environnement et du Développement (CGEDD), Home Prices in France, 1200-2012 : Historical French Property Price Trends, home price index of Paris*], Netherlands [*Piet M.A. Eichholtz, 1997, "The long run house price index: The Herengracht index, 1628-1973", Real Estate Economics, (25), 175-192., this index is based on the transactions of the buildings on the Herengracht, one of the canals in Amsterdam; for recent data the source is OECD*], Australia [*Stapledon, Nigel David, "Long-term housing prices in Australia and Some Economic Perspectives", The University of New South Wales, Sep 2007; Australian median city house prices*], Spain [*before 1970 - source: Prados de la Escosura; after 1970 source is OECD*]; Finland [*Hjerppe, Riitta, Finland's Historical National Accounts 1860-1994: Calculation Methods and Statistical Tables, Jyväskylän Yliopisto Historian Laitos Suomen Historian Julkaisuja, 24, pp. 158-160; and OECD for recent data*], Canada [*Statistics Canada*

and OECD], Japan [*The Japan Real Estate Institute, for data between 1910 and 1940 Nanjo, Takashi, "Developments in Land Prices and Bank Lending in Interwar Japan: Effects of the Real Estate Finance Problem on the Banking Industry," IMES Discussion Paper Series, 2002-E-10, Bank of Japan, 2002*]. For the cases of Denmark, Germany, Ireland, Italy, Sweden, Belgium, Switzerland and New Zealand, the OECD house price index was used.

Short term interest rate:

See Michael D. Bordo, Christopher M. Meissner "Does Inequality Lead to a Financial Crisis?"
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Money:

M2 or M3 – depending on the country. Source: Moritz Schularick and Alan M. Taylor. "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008"
American Economic Review 2012, 102(2): 1029–1061

Stock market index (close, end of December).

The source is Global Financial Data.com

Real Commodity Prices

The Economist All-Commodity Dollar Index (close, end of December). The source is Global Financial Data.com

Financial Liberalization Index, 0 to 21,

Sum of seven components [creditcontrols, intratecontrols, entrybarriers, bankingsuperv, privatization, intlcapital, securitymarkets]. Abdul Abiad, Enrica Detragiache, and Thierry Tresselt
"A New Database of Financial Reforms" IMF WP/08/275

Credit

Loans to GDP ratio. Total lending, or bank loans, is defined as the end-of-year amount of outstanding domestic currency lending by domestic banks to domestic households and nonfinancial corporations (excluding lending within the financial system). Banks are defined broadly as monetary financial institutions and include savings banks, postal banks, credit unions, mortgage associations, and building societies whenever the data are available. We excluded brokerage houses, finance companies, insurance firms, and other financial institutions. See Michael D. Bordo, Christopher M. Meissner "Does Inequality Lead to a Financial Crisis?" NBER Working Paper No. 17896

Current Account

Current account to GDP ratio. See Michael D. Bordo, Christopher M. Meissner "Does Inequality Lead to a Financial Crisis?" NBER Working Paper No. 17896